BUREAU OF HYGIENE AND TROPICAL DISEASES.

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## DISEASES DUE TO PROTOZOAN PARASITES.

DAVIS (L. J.). **On a Piroplasm of the Sudanese Wild Cat** (*Felis ocreata*). —*Trans. Roy. Soc. Trop. Med. & Hyg.* 1929. Apr. Vol. 22. No. 6. pp. 523–534. With 4 figs.

The author figures and describes a piroplasm found in the blood of a young wild cat from the Nuba Mountains Province, Anglo-Egyptian Sudan. The organism was a typical small piroplasm showing ring, pear-shaped, amoeboid, and cross forms, and it ranged from 1 to 2·25$\mu$ in size.

The infection in the original animal has been followed for 12 months and it was found that the percentage of corpuscles invaded rose from 0·5 per cent. at the time of first observation to 8 per cent. a month later, and then fell to about 0·4 per cent., around which figure small fluctuations have occurred. At no time was there any evidence of ill-health; jaundice and haematuria (? haemoglobinuria) have not occurred. During the period of observation there was a very marked drop in the number of red corpuscles, but this was restored. It is noted that the leucocyte count has risen from 21,000 to 51,600.

Experimental inoculation by any path has been successful in every one of 22 experiments with domestic cats. The period of incubation has ranged from 7 to 26 days. The period of incubation appears to be influenced directly by the dose of infective blood, but not by the path selected. In the course of five passages no change of virulence has been observed. No ectoparasites could be found and nothing is known of the natural method of transmission.

Attempts to infect dogs, sheep, calf, white mice and rats, and gerbils have all failed. In experimentally-infected animals the disease tends to run a uniform course. During the first month the percentage of corpuscles infected rises until it reaches about 1, after which it declines and the animal is left with a slight fluctuating infection which persists indefinitely. Blood counts made at frequent intervals failed to show any evidence of reduction in the number of red cells, but there was a tendency for the leucocyte count to rise. There was no rise of temperature, jaundice or haematuria [sic].

The intravenous injection of 2 cc. of a 1·5 per cent. solution of trypanblue appeared to be without effect.

The effect of splenectomy is being studied, and up to the time of writing this operation had been performed on two animals during the later stages of infection, on one during the early stage and on two prior to inoculation. In the two animals operated upon during the later stages of infection there was a steady increase in the number of

parasitized cells from 0·05 per cent. at the time of operation to 90 per cent. on the 22nd day after operation Then the invasion declined to about 3 to 5 per cent., at which figure it has remained.

There was no jaundice at any time.

In the animal operated upon on the second day after the appearance of parasites in the blood there was a rise from 1 per cent. to 65 per cent. in 11 days. On the 10th day there was haemoglobinuria, but no jaundice. The cat was killed on the 11th day.

Of the two cats operated upon prior to inoculation one died of intercurrent disease, while the other showed a rapid rise up to 95 per cent. of invaded corpuscles in 9 days. The blood count fell from 5,000,000 to 1,700,000 in 24 hours. There was haemoglobinuria, but no jaundice. The temperature was 101° F. Death occurred. There was fatty degeneration and cloudy swelling of the liver and kidneys. Tuberculosis of the lungs and lymph glands probably contributed to the fatal result.

Although large numbers of examinations have been made no evidence of schizogony has been found.

The methods of BASS and JOHNS and of ZIEMANN were employed in attempts to cultivate the parasite, but without success. The parasite retained its power to infect up to the 10th day, but there was no multiplication.

Bodies resembling anaplasmata were found constantly in the infected and in healthy cats, and the number of corpuscles showing these ranged from 0·08 to 0·12 per cent.

The name *Babesia felis* is suggested.

OGURA (K.). Ueber Rinderpiroplaśmose in Hokkaido (Japan). [**Bovine Piroplasmosis in Japan.**]—*Jl. Jap. Soc. Vet. Sci.* 1929. Mar. Vol. 8. No. 1. pp. 1–37. With 9 figs. on 3 plates (1 coloured).

Piroplasmosis in Hokkaido may be caused by two types of parasite—a large one resembling *B. bigeminum* and a small one of the *B. mutans* type. Mixed infections may occur.

When the small type is responsible it can readily be found in the blood, but it is not always possible to find the large parasite in the peripheral blood. Its presence can, however, be demonstrated by inoculation of a susceptible animal.

Dullness, anaemia, jaundice and haemoglobinuria are the principal symptoms. At post-mortem examination enlargement and softening of the spleen, biliary congestion and parenchymatous degeneration of the liver, parenchymatous degeneration of the kidneys, and oedema of the lungs are the more important lesions.

RASTEGÄÏEFF (E. F.). Zur Frage der Identität der Babesiellen im nordwestlichen Gebiet Russlands. [**The Identity of the Babesiellas in North-Western Russia.**]—*Berlin. Tierärzt. Woch.* 1929. Apr. 5. Vol. 45. No. 14. pp. 233–234.

According to YAKIMOFF 6 organisms capable of causing haemoglobinuria are known to occur in Russia. These are *Piroplasma bigeminum*, *Babesiella bovis* Babes, 1888, *Babesiella karelica* Yakimoff, 1927, *Francaiella caucasica* Yakimoff and Belawine, 1926, *Francaiella colchica* Yakimoff, 1927, *Francaiella occidentalis* Yakimoff and Bourzeff, 1927.

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QUEVEDO (J. M.). Los diversos hemosporidios en la llamada "Tristeza" de los bovinos. [**The Parasites responsible for the Disease known as "Tristeza" in Bovines.**]—*Revist. Hig. Sanid. Pecuarias.* 1929. Mar. Vol. 19. No. 3. pp. 161–165. [French summary p. 166.]

This short paper is a summary of the diseases caused by intracorpuscular parasites in bovines.

The author concludes that Tristeza may be caused by *B. bigeminum*, which occurs in all parts of the world, *Babesiella minor*, which is peculiar to South America, and *Anaplasma marginale*.

As a rule anaplasmosis follows an attack by one or other of the other two parasites.

HESS (A.). Beitrag zur Behandlung der Rinderpiroplasmose mit Hexamethylentetramin. [**The Treatment of Bovine Piroplasmosis with Hexamethylamintetramine.**]—*Berlin. Tierärzt. Woch.* 1929. Apr. 5. Vol. 45. No. 14. pp. 229–230.

The author records the results of treatment of eight cases of piroplasmosis with hexamethylamine, but in two of these trypanblue was also used. The doses given ranged from 15 to 20 cc. dissolved in 50 cubic centimetres of distilled water, injected subcutaneously, and this dose could be repeated. It appeared to have good results. Advantages of the drug are that it can be obtained anywhere and is cheap.

KLARIN (E.). Skyddsympning mot piroplasmos år 1928. [**Protective Inoculation against Piroplasmosis in 1928.**]—*Skandinav. Vet. Tidskr.* 1929. Mar. Vol. 19. No. 3. pp. 41–68. [Author's English abstract.]

During March 1928, vaccine against bovine piroplasmosis was obtained from the State Veterinary Bacteriological Institute, Stockholm. This vaccine took the form of citrated blood from a calf which had repeatedly been injected subcutaneously during 1927 with blood from cattle suffering from piroplasmosis. The vaccine was to be used only in herds in which cases of piroplasmosis occurred. It was to be used within 8 days, in doses of 3 cc., and preferably for the inoculation of calves and young animals, and inoculated animals were to be kept housed for a fortnight. Pregnant, recently calved animals were not to be inoculated although adult animals might be done if they were in good health. In such animals serious reactions were to be expected. Between April and July 2,750 doses of vaccine were sent to 52 veterinary surgeons, and reports were received regarding 2,023 animals. In only 15 per cent. of animals was there any recognizable reaction. This took the form of a rise of temperature during the first or second week. In 30 cases there was haemoglobinuria, but only 12 of these were serious. One of these animals had to be slaughtered and 3 died. It is believed that these unfavourable results were due to conditions existing prior to inoculation or to the animals being sent out to graze too soon after inoculation.

In some herds animals were left uninoculated and a tabular statement shows the number of cases of piroplasmosis and the number of deaths among these as compared with the inoculated. The results are not very markedly different from each other. The explanation offered is that the inoculated animals were exposed to greater risks. Many of the uninoculated had not been in infected pastures, and no doubt many of them had already had an attack of piroplasmosis. One hundred and

eighty doses of vaccine were also obtained from a cow which had been experimentally infected four or five months before. Of 151 animals receiving this vaccine none developed piroplasmosis. One death occurred among the uninoculated in the same herd.

ADLER (S.) & THEODOR (O.). **Attempts to transmit** *Leishmania tropica* **by Bite: the Transmission of** *L. tropica* **by** *Phlebotomus sergenti.*—*Ann. Trop. Med. & Parasitol.* 1929. Apr. 26. Vol. 23. No. 1. pp. 1–18. With 1 plate.

The authors detail experiments in which sand flies (*P. papatasii*) were infected with cultures of *L. tropica* prepared with a strain isolated from a human being who had been inoculated from another. These flies were allowed to bite 12 persons and a puppy. Only one of the volunteers developed a lesion, but although the lesion developed at the site of bites natural infection was not excluded because the volunteer lived in a quarter where oriental sore occurred.

In experiments with a membrane it was shown that *L. tropica* may leave infected *P. papatasii* by way of the proboscis. Further, it was found that exflagellation and development occur in *P. sergenti* as in *P. papatasii.*

ADLER (S.) & THEODOR (O.). **Additional Evidence on the Occurrence of** *L. tropica* **in Wild** *Phlebotomus papatasii.*—*Ann. Trop. Med. & Parasitol.* 1929. Apr. 26. Vol. 23. No. 1. pp. 19–21.

The authors describe a case in which *L. tropica* was found in wild *P. papatasii,* and in this instance it was proved that the parasite was infective for man.

DONATIEN (A.) & LESTOQUARD (F.). La leishmaniose viscérale du chien. [**Visceral Leishmaniasis of the Dog.**]—*Rev. Vét. et Jl. Méd. Vét.* 1929. Mar. Vol. 81. pp. 117–135. With 2 text figs.

In the words of the authors, this paper is a kind of review of the subject of visceral canine leishmaniasis with the results of work carried out in Algeria where this condition is of frequent occurrence.

Leishmaniasis is practically confined to human beings and dogs under natural conditions, and in both of these a visceral and a cutaneous form of the disease occur. In man visceral leishmaniasis is a very fatal condition. In adults it is encountered in India and in the Sudan and the cause is *L. donovani.* Infantile kala azar, which is particularly a disease of the Mediterranean seaboard is caused by *L. infantum.* The cutaneous leishmaniasis of man are oriental sore, caused by *L. tropica* and American leishmaniasis, caused by *L. brasiliensis.*

Cutaneous leishmaniases of the dog is of little or no importance in northern Africa; only one case has come under observation, but it occurs frequently in Turkestan and Persia; at Biskra, where human cutaneous leishmaniasis is of common occurrence, no case has ever come under observation. There appears to be a possibility that the single case of canine leishmaniasis of the skin seen in Northern Africa was actually due to *L. tropica.* The identification of the parasite causing visceral leishmaniasis of the dog is still a matter of discussion. It is a fact that the disease occurs in those countries where infantile kala azar occurs, but the latter condition is the more rare. It is therefore probable that visceral leishmaniasis of the dog is caused by *L. infantum.* The dog may actually be the reservoir of the virus of the human disease.

The organisms belonging to the group Leishmania are flagellate parasites of certain insects, and they are able to infect mammals, in which they acquire an aflagellate form. *L. infantum* as a parasite of vertebrates invades, in order of frequence, the spleen, the bone marrow, the liver, the glands, the skin and the cornea, and in certain phases of the disease, the peripheral blood.

As a general rule the parasites are to be found included within cells—vascular endothelium and macrophages, and it was at one time thought that the organism was an active invader of such cells. This, however, is not the case as it is non motile in this phase. Actually the parasites are taken into the cell cytoplasm through the activity of the somatic cells. They are capable of multiplying after this has occurred. Hence one finds clusters of parasites within the cells.

It has been stated that Leishmania is capable of invading epithelial cells and even blood corpuscles, but these statements are inaccurate. For the satisfactory staining of the parasite the author recommends fixation of fresh films in 95 per cent. alcohol containing 2 per cent. iodine, washing with alcohol, and staining in a solution prepared as follows :— Slightly acid distilled water containing 10 per cent. horse serum and trieosinate of methylene blue in the proportion of 15 drops to 5 cc. This is allowed to act for 30 to 45 minutes.

The parasites are ovoid in shape, measuring from 2 to 6 $\mu$ in their greater diameter. They contain a large more or less spherical nucleus, and a second rod-shaped chromatin structure—the blepharoplast. In well stained preparations there can be seen the rhizoplast connecting the blepharoplast to one pole of the parasite. The whole of the cytoplasm is surrounded by a rigid shell-like envelope which is best seen when it is devoid of contents. Multiplication takes place by longitudinal fission.

Leishmania is one of the few parasitic protozoa which can be cultivated artificially even in series. For the purpose Novy-Neal-Nicolle blood agar is used. Growth takes place at 22° to 24° C. in the water of condensation. In artificial cultures the parasite develops as a Leptomonas and frequently "rosettes" form in which the flagella of a number of parasites are entwined in the centre and the long ovoid bodies are round the margin. In this condition the parasites are motionless. The large round nucleus is practically central in position, and between it and the flagellum is the rod-shaped blepharoplast. The cytoplasm of the cultivated organisms takes the stain more intensely than those in the mammalian body, but one can usually make out a vacuole in the neighbourhood of the blepharoplast. The vitality of the organism in culture is of relatively short duration, but by frequent subcultivation the organism can be kept practically indefinitely.

While it is possible, by taking certain precautions, to transmit the disease to dogs in series, there is very considerable difficulty about producing the disease by means of artificial cultures. It appears to be probable that in artificial cultures the power of infecting is soon lost.

The parasite is transmissible to the dog, jackal, monkey, dormouse and white mouse. In carrying out experimental transmissions with dogs the following points are of importance. Material should not be taken from a severe case of the disease, and it should be collected within an hour or so of death from the bone marrow or, failing that, from the spleen. Doses of considerable size should be given into the peritoneal cavity.

Intradermal inoculation produces a localized lesion only.

As yet the problem of the natural method of infection has not been solved, but it is very probable that Phlebotomus plays the part of insect vector.

The symptomatology of the condition cannot be studied in experimental cases as these almost invariably run a benign course. In natural cases there appears to be no connexion between the degree of infection and the severity of the symptoms. Individual resistance appears to play a big part. Wasting and depression are the most obvious symptoms, and there is in some cases paresis. Dyspnoea is sometimes pronounced and the respiration may suggest the presence of broncho-pneumonia, but there is no nasal discharge and no evidence of pneumonia can be obtained by auscultation. As a rule there is no fever. Loss of hair with epithelial desquamation, but without pruritus, is often seen, as are ulcerations of the skin. Interstitial keratitis is frequently seen.

It is not yet determined whether an attack leaves immunity or whether the resistance to second infection is due to "premunization."

Diagnosis is based upon the detection of the parasite. Bone marrow obtained from the femur by trephining is one of the best methods. The formol-gel test (2 drops of formalin to 20 drops of serum) is said to be absolutely reliable.

Up to the present tartar emetic appears to be the only drug of any value for the treatment of the disease.

BENNETT (S. C. J.) & KENNY (P. A. C.). **Mercuric Chloride as a Diagnostic Agent for Trypanosomiasis in Camels.**—*Jl. Comp. Path. & Therap.* 1928. Dec. Vol. 41. No. 4. pp. 341–353.

The routine method of controlling camel trypanosomiasis in the Sudan comprises diagnosis by the formol-gel test, with confirmation when possible by microscopic examination of the blood and treatment of all reactors with 10 g. of naganol intravenously. There is no doubt that naganol is effective in nearly every case of infection with *T. soudanense* as a primary treatment. The control of the disease will therefore depend upon accuracy of diagnosis, and any new method of diagnosis must be compared with the formol-gel test for the purpose of obtaining some standard of its efficacy.

It has been found that not every infected camel develops the capacity to react to the formol-gel test, and further that non-infected camels may temporarily give a positive reaction. This is, however, of minor importance, as it is preferable to treat a few uninfected camels than to allow infected camels to escape detection. The stabilization of the technique of the formol-gel test is still a matter of concern, particularly from the point of view of eliminating doubtful reactions. Another objection is the amount of time required for the test, particularly if a fairly large number of animals are under examination. Samples of blood collected on one day must be left till the next day to express their serum and there must be a further interval of 24 hours before the tests are read off.

Since the mechanism of the formol-gel test is probably connected with the instability of certain serum globulins, it appeared to be possible that some other agent or agents might be as effective, if not more so, than formalin. A number of substances have been tried, and the first to give uniform results was mercuric chloride. Starting with a saturated solution, various dilutions were made until one was reached which caused no visible change when mixed with normal serum, and this point

was reached at one volume of saturated solution diluted to 1,000 volumes.

The following is a summary of the preliminary observations on mixtures of mercuric chloride solution and camel serum.

When 1 or 2 drops of the solution are mixed with 1 or 2 cc. of serum, no change occurs whether the serum be from diseased or from healthy camels.

When the two are mixed in approximately equal proportions an opalescence develops in all cases.

When 1 or 2 drops of serum are added to 1 or 2 cc. of the perchloride solution, a white precipitate is formed in the case of known infected camels, but not in the case of normal camels.

If a drop of serum be added to 5 to 10 cc. of perchloride solution, a white precipitate is formed in all cases.

For preliminary trials the technique was fixed as follows :—One drop of serum was added to 1 cc. of one-thousandth saturated solution of mercuric chloride in test tubes of about $\frac{3}{8}$-in. bore, the tubes being then gently shaken. The results were recorded in terms of opacity after 15 minutes. If tubes are left longer than this before the results are read the differences are very, very slight.

Preliminary tests were carried out on 56 camels, and a summary of the tabulated results of microscopic examination, the formol-gel test, and the mercuric chloride test shows as follows :—

| | | |
|---|---|---|
| Positive | to all three tests ... ... ... ... | 3 camels. |
| ,, | to micro. exam. and mercury ... ... | 14 ,, |
| ,, | to formol-gel and mercury ... ... ... | 3 ,, |
| ,, | to mercury only ... ... ... ... | 2 ,, |
| Negative | to mercury and positive to any other ... | Nil |
| Negative | to all tests ... ... ... ... ... | 34 ,, |

Thus the mercuric chloride test detected infected camels when the other tests failed.

| | |
|---|---|
| When micro. exam. failed ... ... ... ... | 5 times. |
| When formol-gel test failed ... ... ... | 16 ,, |
| When both failed ... ... ... ... ... | 2 ,, |

In the case of the 16 failures of the formol-gel test, 14 of the animals were recently infected experimental animals and not clinical field cases. This, however, indicates that the mercuric chloride test may possibly detect cases earlier than the formol-gel test. The question as to whether the negative animals were actually not infected does not call for discussion, since the relative value of the formol-gel and the mercuric chloride tests are being considered.

Experiments were carried out with a series of solutions of perchloride of mercury ranging from 1 in 5,000 to 1 in 25,000 for the purpose of developing an accurate technique. These were tested with sera from clean and infected camels. Further tests were also made in which the amount of serum added to the 1 cc. of perchloride solution was varied. From the results obtained it appeared that the most useful strengths of perchloride solution would be from 1 in 15,000 upwards, and that the amount of serum to be added to 1 cc. would be one-half, or 1 drop.

As the second of these is the easiest to employ, it was always used in routine tests. Special attention is drawn to what is described as a "very interesting essential" in the technique, namely, that whether pure or diluted (to get one-half drops) serum is added to the solution it must be in the form of a drop. It is recorded in the tabular statement

given that when 2 or 3 drops of serum were added to 1 cc. the tests could "not be read owing to opalescence." This, it is said, is not strictly accurate, as the true explanation is that the first drop produces the usual one-drop precipitate, and the addition of further drops alters this in some way but does not clear it up. That it is not merely the proportions of serum and solution can be proved by adding 1 drop of serum to half or a quarter of a cubic centimetre of solution, whereupon no change occurs.

The question next investigated was the lowest dilution of mercuric chloride with which serum from normal camels would fail to give a precipitate. Several infected camels and a large number of clean camels were available. Twenty-three clean camels were tested and in no case was a precipitate produced in a dilution higher than 1 in 15,000, and in 12 of these the highest dilution was 1 in 10,000. The sera of infected camels produced precipitates in dilutions up to 1 in 50,000 or higher. It thus appears to be safe to regard a camel as infected when the titre is 1 in 20,000 or over.

It has been shown that camels may develop a positive reaction to the perchloride test before they become positive to the formol-gel test, but it was desirable to ascertain what interval may elapse between the development of the power to react to the two tests, and secondly whether an animal which never becomes positive to the formol-gel test will acquire the power to react to the perchloride test. Details are given of four cases which were kept under observation with frequent tests for periods ranging from a fortnight to about 6 months. Two other camels, infected in the course of another experiment, were also kept under similar observation. Of these 6 animals 1 developed the power to react to the perchloride test within a week and the remainder within 2 weeks. Of the 4, of which detailed records are given, 1 first reacted to the formol-gel test on the 17th day, having reacted to the perchloride test on the 10th day (*i.e.*, taking 1 in 20,000 as indicating infection), while another reacted to the perchloride test on the 22nd day but was giving "partial" reactions to the formol-gel test up to 6 weeks after infection becoming definitely positive after that only. One of the 4 animals died of acute trypanosomiasis in 3 weeks and had given partial reactions to the perchloride test from the 6th day and no reaction to the formol-gel test. The fourth animal of this batch was definitely positive to the perchloride test on the 21st day and remained so for nearly 3 months, but over a period of observation of 6 months it never became positive to the formol-gel test. Infection was proved by rat inoculation about 6 weeks after inoculation.

The ultimate titre is not a matter of great consequence, but it is of interest when pursued to infinity. It is found that after a dilution of about 1 in 100,000 mercuric chloride the presence of the salt is not necessary, and a faint haze will appear if the serum of an infected camel be dropped into pure distilled water. This phenomenon has not been studied, but it tends to support the *a priori* conception that the whole phenomenon is referable to the globulin fractions of the serum.

The author does not propose to formulate any general conclusions at the moment because further work may modify views at present held, but the experiments carried out up to the present appear to warrant the statements to the following effect :—

A positive reaction is indicated by the formation of an opacity when 1 drop of serum is added to 1 cc. of a dilution of mercuric chloride of 1 in 20,000 or higher dilution.

Infected camels react to the test earlier than to the formol-gel test, and may react before trypanosomes appear in the blood.

The test is more easily and more rapidly carried out than the formol-gel test, and its results are more easily assessed.

CAROUGEAU. Trypanosomiase bovine à la Guadeloupe. [**Bovine Trypanosomiasis in Guadeloupe.**]—*Bull. Soc. Path. Exot.* 1929. Apr. 10. Vol. 22. No. 4. pp. 246–247.

Blood smears sent from Fort de France were found to contain trypanosomes, which in MESNIL'S view belong to the *cazalboui* group. The veterinary officer sending the smears states that the first cases occurred about a year ago, and he attributes the infection to animals brought from Venezuela and Colombia. In Martinique grazing is so scanty that no beef animals can be fed; all animals for slaughter are imported.

To check the importation of the disease all imported animals are to be housed in flyproof buildings until slaughtered, and there is a scheme in view of providing cold storage so that cattle may be slaughtered immediately on landing. All centres of infection within the island must be traced and the animals slaughtered or treated. The difficulties of this process are not overlooked.

RASTÉGAÏEFF (E. F.). Sur une espèce nouvelle de coccidies. [**A New Species of Coccidium.**]—*Bull. Soc. Path. Exot.* 1929. Feb. 13. Vol. 22. No. 2. pp. 69–70.

The author describes a coccidium found in the faeces of an Indian nilghai (*Boselaphus tragocamelus*) in the Zoological Gardens at Leningrad.

The parasite was found to require 11 days for sporulation in water containing bichromate of potash. There appears to be an error in the dimensions given for the oocyst, which are said to be $41{\cdot}9\mu \times 6{\cdot}9\mu$. Later it is said that when the material was examined on the 15th day coccidia measuring $32{\cdot}4\mu \times 28{\cdot}8\mu$ could be found. The sporocysts measured $14\mu \times 9\mu$. The author is not able to say whether residual bodies occur in either the oocyst or the sporocyst.

Finally, the author considers the coccidium to be a new species and suggests the name *E. yakimovi*. The longer diameter of the oocyst is here given as ranging from $32{\cdot}4\mu$ to $41{\cdot}4\mu$.

NIKOLSKY (S. N.). La coccidiose des bovidés et des moutons dans le Caucase du Nord. [**Bovine and Ovine Coccidiosis in the Northern Caucasus.**]—*Bull. Soc. Path. Exot.* 1929. Feb. 13. Vol. 22. No. 2. pp. 71–72.

This note records the occurrence of coccidiosis in calves of about one year old and also the detection of oocysts in the faeces of sheep collected at the slaughterhouse at Piatigorsk.

BUGGE (G.). Zur Leberkokzidiose des Schweines. [**Liver Coccidiosis in the Pig.**]—*Berlin. Tierärzt. Woch.* 1929. Mar. 1. Vol. 45. No. 9. pp. 139–141. With 2 text figs.

The author discusses the case of coccidiosis of the liver of the pig described by JOHNE in 1881, and comes to the conclusion that the lesions

produced were due to *Fasciola hepatica* and not to coccidia, and that the structures mistaken for coccidia in the bile ducts were in reality the eggs of Fasciola.

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ERNELIN (V.) & ZEISS (H.). Die Bekämpfung der Kameltrypanosomiase in Russland. [**The Control of Camel Trypanosomiasis in Russia.**]—Reprint from *Compt. Rend. Acad. Sci.* U.R.S.S. [Undated. The paper was presented March 14th, 1928.]

PIRANI (A.). Spirillosi ed altre malattie dei polli nella Colonia Eritrea. [**Spirillosis and other Diseases of Poultry in Eritrea.**]—*La Nuova Vet.* 1929. May 15. Vol. 7. No. 5. pp. 131–136. With 2 figs.

TARANTINO (G. B.). Tripanosi del dromedario nella Somalia Italiana. [**Trypanosomiasis of the Dromedary in Italian Somaliland.**]—*La Clin. Vet.* 1929. Feb. Vol. 52. No. 2. pp. 77–79.

ZIBORDI (D.). Di un caso di sarcosporidiosi nel lama. [**A Case of Sarcosporidiosis in a Llama.**]—*La Clin. Vet.* 1928. July. Vol. 51. No. 7. pp. 415–423. With 2 text figs.

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## DISEASES DUE TO METAZOAN PARASITES.

ROSS (I. Clunies) & MCKAY (A. C.). **The Development of** *Fasciola hepatica* **L. in the Final Host.**—*Australian Vet. Jl.* 1929. Mar. Vol. 5. No. 1. pp. 17–23. With 3 text figs.

The main object of the experiments detailed here was to determine the time at which young flukes entered the liver, with special reference to the amount of injury caused by their passage into that organ.

It is regretted that the bulk of the cercariae had to be obtained from experimental infestations, as naturally infected snails were not readily obtainable. The number of experiments is therefore rather small.

Development to the 9th day after infestation. A guineapig was fed with 35 cercariae in bran, and was killed 5 days later. Twelve fine fluke burrows could be found, and there were a number of white spots which marked the points of entry of other flukes. There was no evidence of haemorrhage from the surface of the organ.

Dissection revealed the presence of fluke measuring 350$\mu$ to 420$\mu$. In these the intestine showed the earliest signs of branching. No fluke could be found in peritoneal washings. The first part of the small intestine showed punctate haemorrhages where the fluke had emerged.

A guineapig killed 9 days after feeding with cercariae showed more numerous and larger fluke burrows. There was no evidence of haemorrhage, but when the liver was handled, blood oozed from the burrows. Dissection of a piece of liver revealed the presence of flukes 1 to 1·5 mm. in length. No flukes were found in peritoneal washings.

It is probable, therefore, that young fluke enter the liver within a few days of ingestion of cercariae.

Further experiments were carried out to determine the course and development of the parasites in the liver, the injury caused, the time at which death takes place after infestation with a large number of cercariae, and the time elapsing before the fluke make their way into the bile ducts.

A rabbit killed on the 16th day showed a condition of the liver resembling that shown by the guineapig killed on the 9th day. The burrows were larger and blood oozed through the ruptured capsule in places.

A rabbit killed 24 days after feeding with cercariae showed several ounces of bloodstained serum in its peritoneal cavity, while the surface of the liver was mottled with fibrinous clots. The surface of the liver was rendered irregular by the number of fluke burrows which covered it. Fluke measuring 2 to 2·8 mm. were recovered. None were found in the peritoneum or the other organs.

A second rabbit treated in the same way showed a similar set of conditions when killed on the 24th day.

A guineapig was fed with 500 cercariae spread over a period of 5 days. The animal died on the 30th day after the first feeding. The post-mortem findings were similar, but the fluke recovered measured 2·8 to 4 mm. Several fluke were found in the peritoneal cavity. The fluke showed branched ovary and testes. Examination of sections of the liver showed enormous destruction of liver tissue, haemorrhage and periportal fibrosis. The sections showed no fluke in the bile ducts. A further guineapig died on the 39th day after feeding. Similar lesions were found. No fluke were found in the bile ducts. No experiments were carried out with sheep, but the above findings have been confirmed by the examination of sheep showing early infestations. Young fluke measuring as much as 3 mm. in cross section have been found in the liver tissue.

FAIRLEY (N. Hamilton) & PENROSE (J. S.). **A Survey of the Incidence of Hydatid Disease in the Herbivora and Porcines of Victoria.**—*Med. Jl. Australia.* 1928. Nov. 24. Vol. 2. 15th year (ex. *Australian Vet. Jl.* 1929. Mar. Vol. 5. No. 1. pp. 3–10).

The work has been undertaken to provide accurate statistical information regarding the incidence of hydatid disease, as without it no conclusions can be drawn from ascertained facts whether any given disease is decreasing or increasing in frequence. It is hoped to repeat the surveys at intervals of 2 years.

The authors emphasize their opinion that ordinary abattoir staffs cannot undertake the surveys, and that figures based upon the condemnation of organs as unfit for human consumption are too low for statistical purposes. The age factor must also be taken into account.

For the observations recorded in this paper a number of extra clerks and inspectors were employed in order that the results might be as accurate as possible.

In sheep the liver and lungs were closely examined, but it was not practicable to do more than make a superficial examination of the spleen and kidneys. In pigs these organs were subjected to close examination. No special examination was made of the heart, but this was immaterial, as hydatids in the heart, spleen and kidneys are comparatively rare in sheep, and when they occur in these places they are found elsewhere as well.

The observations were made in Victoria, where no statistical figures were available. In Western Australia the available figures show both sheep and cattle to be infested to the extent of about 20 per cent. (1908). It is suggested that a new survey in this State might yield higher figures. In New South Wales (1926) a small survey gave approximately 35 per cent. of both cattle and sheep infested.

Of 4,000 merino sheep 22·7 per cent. were found infested, and of some 7,000 cross-breds 13·1 per cent. The difference in percentage is influenced by the fact that 56 per cent. of the cross-bred animals were

lambs, while of the merinos only 0·9 per cent. were lambs. And the proportion of full-mouthed sheep in two groups was 28·5 and 83·7 per cent. Cysts are found about 4 times as frequently in full-mouthed animals as in lambs.

In the case of cross-bred animals the percentage infested at under 3 years was approximately the same in males and females, while in sheep over 3 years old nearly 3 times as many females were found to harbour the parasite as males.

Among the merinos under 3 years of age the percentage of infested males was about twice that of females (15 and 8 per cent.). Of those over 3 years of age about twice as many females as males were infested (35 and 18 per cent.).

Acquired immunity to metazoal disease is a very rare phenomenon, and infestation must therefore increase with age.

It was not found possible to determine the geographical distribution of the parasite from the observations made, but a record is given of the percentages found infested from different divisions of the State. This percentage ranges from 28 to 1 per cent.

Of over 2,000 male and nearly 3,000 female bovines 20 and 26 per cent. were found infested.

It was found, as in the case of sheep, that increasing age is coupled with increase in the number of animals affected. A table shows that there is an increase in the percentage infested from 3·5 per cent. in calves to 36 per cent. in animals of 3 years and over.

Of about 2,500 pigs examined, 0·5 per cent. were parasitized.

In sheep the cysts are almost always multiple and undegenerated, but in cattle the cysts are generally sterile and degenerated.

Sheep are therefore the most important factor in the survival of the parasite. Prophylaxis depends upon control of infestation in dogs. Ross's survey (1926) showed that 40 per cent. of station dogs, 25 per cent. of slaughter-yard dogs, 7·1 per cent. of drovers' dogs and 0 per cent. of city dogs are infested with *E. granulosus*.

It is undoubtedly the slaughterhouses in the small country towns, the farms and sheep stations which constitute the weak link, and no material improvement can be expected until this is remedied.

The feeding of dogs with raw offal, unless it has been inspected, should be prohibited; and much might be done on educational lines.

GULATI (A. N.). **Description of a New Species of Tapeworm** *Dipylidium catus*, **n. sp. with a Note on the Genus** *Dipylidium* **Leuckart 1863.** —*Bull. 190. Agric. Res. Inst. Pusa, India.* 1929. 14 pp. With 5 text figs.

The author figures and describes a tape worm of which 500 were found in a cat in the Almora district of the United Provinces.

BAUDET (E. A. R. F.). Trichostrongylosis bij Schapen. [**Trichostrongylosis in the Sheep.**]—*Tijdschr. v. Diergeneesk.* 1929. Apr. 1. Vol. 56. No. 7. pp. 325–333. With 7 text figs. [Author's English Abstract.]

This paper contains nothing new. The author describes *Trichostrongylus vitrinus*, *Tr. extenuatus*, and *Nematodirus filicollis*, which cause serious disease among sheep in Holland.

100 cc. of 1 per cent. sulphate of copper after a 16-hour fast is the dose for an adult animal, and this is sometimes effective against *H. contortus*. It is useless against the small trichostroxgyles.

KLARENBEEK (A.). Het Vraagstuk der longworminfectie bij zilvervossen. [**Lung Worm in Silver Foxes.**]—*Tijdschr. v. Diergeneesk.* 1929. Apr. 15. Vol. 56. No. 8. pp. 381–388. With 5 figs. [Author's English abstract.]

In the faeces of 23 out of 62 silver foxes, the author found "lemon-shaped" worm eggs. At post-mortem examination he found *Capillaria aerophilia* in the trachea. In one fox he found *Crenosoma vulpis*.

HENRY (A.). Observations sur diverses gales ou leurs agents. [**Observations upon Various Kinds of Mange or their Causal Agents.**]—*Rec. Méd. Vét.* 1928. Nov. Vol. 104. No. 11. pp. 641–646. With 1 text fig.

(i) The transmission of Mange from Rats to Bovines.—The author describes a case in which *Notoedrus alepis* of the black rat caused some cases of mange in Jersey cattle. The byres were overrun with affected rats.

(ii) Sarcoptic Mange in Gorillas.—Two cases occurring in gorillas imported into France in 1925 are described. The disease was first noticed about 3 months after their arrival from the Congo. Their negro attendant and their owner also developed sarcoptic mange on their forearms, the lesions closely resembling those occurring in human beings affected with equine sarcoptic mange.

Study of the parasites collected in scrapings from one of the gorillas failed to show that they possessed any specific characters.

(iii) Psoroptic Mange in a Gazelle.—This case was encountered in a gazelle (*Gazella leptoceros*) from southern Algeria which had been in Paris for several weeks. The lesions resembled those described by CAPARINI in 1885 as occurring in a gazelle at the Veterinary College at Naples, but they were less extensive than in Caparini's case, and the crusts were more lamella-like and less closely adherent. Psoroptes were found, and these are being examined.

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PETER. Immunisierung des Rindes gegen die Dasselfliegenlarven. Eine theoretische Betrachtung. [**Immunization against Warbles in Cattle. A Theoretical Consideration.**]—*Berlin. Tierärzt. Woch.* 1929. Mar. Vol. 45. No. 13. pp. 209–211.

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## BACTERIAL DISEASES.

VAN DER HOEDEN (J.). Het besmettelijk verwerpen der runderen in verband met ziekten van den mensch. [**The Connection between Contagious Bovine Abortion and Disease of the Human Subject.**]—*Tijdschr. v. Diergeneesk.* 1928. Nov. 1. Vol. 55. No. 21. pp. 1065–1082. [Author's English Abstract.]

The author asks what are the grounds for the view that *Br. abortus* Bang, is capable of setting up undulant fever in man. He questions the value of the experiment carried out by NICOLLE, BURNET, and CONSEIL because it was carried out with laboratory cultures. *Br. abortus* must have a very low power of infectivity for man in view of the extent to which man is exposed to infection. BASTAI'S view that cases of undulant fever contracted from cattle are really due to *Br. melitensis* cannot be accepted in all cases. For example, exception must be taken to it in cases of this kind occurring in Holland and Denmark, where undulant fever does not occur.

During the last year 17 cases of infection with *Br. abortus* have been detected at the Central Laboratory in Holland. In one of these blood culture was positive. An infection experiment with a pregnant heifer yielded a positive result, although a living calf was born. Abortion bacilli were found in the cotyledons. The serum of the heifer was positive to agglutination in 1 in 25,600, and that of the calf to 1 in 12,800 10 days after birth. At the time of birth it was quite negative. Abortion bacilli were cultivated from the udder secretion 10 days after inoculation and from the milk 2 and 10 days after parturition.

It is suggested that infection of human beings with *Br. abortus* has not been detected before because the condition was not recognized clinically, and, further, that the possibility of *Br. abortus* acquiring an exalted virulence cannot be excluded. In the Dutch cases 7 persons were infected by drinking milk and 5 by assisting at parturition cases. In two cases both methods of infection might have been responsible. Abortion bacilli were found in 10 out of 24 samples of milk from farms in the province of Utrecht. It is probable that special factors play some part in the infection of man.

MEYER (C.). Beitrag zur Bang-Infektion des Menschen. (Krankheitsbericht). [**Bang Infection in Man.**]—*Deut. Tierärzt. Woch.* 1929. Feb. 9. Vol. 37. No. 6. pp. 81–83.

The author describes his own infection with *Br. abortus*, which he contracted as a result of cleansing a cow which was infected.

The first thing noticed was pain in the neighbourhood of the nail of the middle finger of the left hand on the evening of the day upon which the after-birth had been removed. There was no injury or inflammation visible. Fever and headache developed about the 10th day accompanied by weakness of the limbs. The temperature was 38·5° and pulse 93. Dullness under the left costal arch and inflammation of the pleura developed. Rigors were pronounced. Repeated blood tests failed to indicate any paratyphoid infection. There was inappetence, loss of strength and marked loss of weight. Blood samples were tested for *Br. abortus* infection in two laboratories with absolutely contradictory

results, a third test at still another laboratory was positive with a titre of 1 : 1,600. Foetid odour of the mouth was a pronounced symptom.

By this time the temperature showed marked variations daily; the difference between the night and morning temperature was sometimes as much as 2 to 2·5°. The pulse was now 120. The case was treated with neo-salvarsan and quinine hydrochloride. The duration of illness was 8 months, and 10 months after infection the agglutination titre was 1 in 800.

POPPE (K.). Die Bang-Infektion des Menschen. [**Infection of Man with Bang's Bacillus.**]—*Deut. Tierärzt. Woch.* 1928. Nov. 24. Vol. 36. No. 47. pp. 781–786. With 2 charts.

Blood tests of 454 samples from human beings suspected of suffering from a variety of diseases have been carried out. In 7 instances the agglutination titre for Bang's bacillus has ranged between 1–200 and 1-6,400. None of these patients was found to be suffering from the diseases suspected (typhoid, paratyphoid, etc.), but they were found to be infected with Bang's bacillus. Five of these persons drank unboiled milk on infected premises and one had to handle an infected cow. In one additional case milk was suspected as the source of infection. In four instances blood culture was resorted to and in one of these the organism was recovered.

The disease set up in man by Bang's bacillus is an undulant fever. It may persist for many months. Febrile attacks last from 10 to 14 days and there are intervals of several days between these when the temperature is normal or nearly so. Neuralgia is frequently noted. The liver and spleen are usually enlarged. During the febrile periods there is leucopenia, but later there is a marked increase in the number of lymphocytes. The diazo reaction of the urine is positive. Clinically the condition bears a considerable resemblance to typhoid, paratyphoid, occult tuberculosis, etc. Acute orchitis with hydrocele has been observed. As yet it is not determined what part Bang infection plays in abortion in human beings, but a few cases are on record in which the serum of such patients has shown a high agglutinating titre.

Further investigation of the question of the infection of children with Bang's bacillus is necessary, but there are records which suggest some connection between rickets and Bang infection.

Infection most frequently occurs in persons who are brought into close contact with infected animals or with materials from cases of abortion, but the risk of infection cannot be very great as so few cases have so far been detected. Blood tests were carried out with samples from 29 practising veterinary surgeons, and in every case the result was negative. Of 14 laboratory assistants tested 2 yielded positive results, but they felt perfectly well. Evidence collected in the United States suggests that human beings may sometimes contract the infection from pigs. This has not been specially noted in Europe, although cases have occurred in Italy and France in which pigs seemed to be the source of infection.

In agglutination tests with human serums 1 : 100 is taken as indicating a positive reaction. Bang's bacillus isolated from human beings appears to be more virulent for cattle and guineapigs than strains of bovine origin.

CADEOT. La fièvre ondulante dans le Gers. [**Undulant Fever in Gers.**]—*Rev. Vét. et Jl. Méd. Vét.* 1929. May. Vol. 81. pp. 255–257.

The author, in compliance with a request from the National Research Laboratory, collected some information regarding the occurrence of abortion in his district where cases of undulant fever were of rare occurrence. In an outbreak of abortion among sheep extending, at the time of investigation, back over a period of about five months, an organism of the Brucella group was incriminated by serological tests, and it was thought probable that it was the melitococcus. A member of the family of the owner (the wife) was ill at the time with an undulant type of fever showing the hepato-renal syndromes. The exact nature of the disease was not established. The shepherd, a lad of about 16, was bitten by the sheep dog and developed arthralgia. The illness was never dangerous, but when recovery took place in about six weeks there was very pronounced anaemia.

A few weeks later the son of the owner of the flock fell sick with rheumatic pains in his joints, intestinal disturbance, and an undulating temperature. The National Research Laboratory made a diagnosis of undulant fever. The case presented serious features, and convalescence was very prolonged.

It is not easily to account for the occurrence of the disease in the owner's wife, as she did not have anything to do with the sheep.

These were not the only cases of the disease in the neighbourhood. The infected flock used to pass daily, prior to their isolation, through a village about 3 miles away, and in this village a woman contracted the disease.

The cattle possessed by the owner of the flock did not show any evidence of being infected with contagious abortion, nor were they sterile.

SOUTHERN RHODESIA. **Annual Report of the Director of Veterinary Research for the Year 1928.** [BEVAN (L!. E. W.).] —13 pp. 1929. Salisbury. S. Rhodesia. Govt. Printer.

This report contains a résumé of work carried out by LAWRENCE (D. A.) regarding bovine abortion and undulant fever.

From two cows the organism was obtained from lesions produced in guineapigs inoculated with milk from infected animals, and also from guineapigs inoculated with mammary tissue. The organism was obtained by direct cultivation from the supramammary gland and from the stomach contents from aborted calves.

Experiments were carried out to differentiate between *Br. abortus* and *Br. melitensis* by inoculation of small animals and subsequent haemoculture.

Three strains were used : (*a*) A locally isolated bovine strain of *Br. abortus*, (*b*) a locally isolated human strain of *Br. abortus*, and (*c*) a stock strain of *Br. melitensis*.

It was shown in each case that a septicaemic condition resulted when guineapigs were inoculated. In the case of the *Br. abortus* strains the septicaemia persisted until the 33rd day after inoculation, and in the case of the *Br. melitensis* up to 15 days. With rabbits no septicaemia could be demonstrated. With each strain one or more guineapigs developed posterior paresis, which tended to improvement and recurrence. In rabbits infected with *Br. abortus* killed at 17 weeks

lesions were noted and the organism was recovered, but no lesions could be found in a rabbit inoculated with *Br. melitensis*.

Attempts to obtain a strain of *Br. abortus* virulent for small animals and the virulence of which could be kept constant failed. Variations occurred in the results in guineapigs inoculated owing to individual variations.

A single attempt was made to find out whether there could be produced any septicaemic state in a bovine, but without success.

HOLTUM (A. W.). **A Determination of the Non-Specific Agglutinin Content of Normal Bovine Sera, and its Bearing on the Interpretation of the Agglutination Test for Bovine Contagious Abortion.**—*Jl. Comp. Path. & Therap.* 1929. Mar. Vol. 42. No. 1. pp. 33–39.

This paper was found among the effects of Holtum after his death.

A brief review is given regarding the views expressed by a small number of investigators who have studied the subject, and it is pointed out that there is a lack of agreement as to what should be considered the lowest limit indicating a positive result, or, in other words, what amount of agglutination may be produced by the serum of non-infected animals.

Holtum used a suspension of bacilli in normal saline containing 0·5 per cent. carbolic. Fresh growths from the surface of agar (pH 7·6–7·8) were used, and the density of the suspension is said to be equal to Brown's tube No. 2 and to 2·8 centimetres on Gates' scale. [There appears to be a discrepancy here, as these standards are not identical.]

The samples of serum were obtained from herds in the Island of Jersey. As a preliminary 18 strains of abortion bacilli were tested with known sera so that a strain of the highest agglutinability might be used in the tests.

In tabular statements the results obtained with 334 sera from 7 herds are given. In the tables only the maximum and minimum reactions are given, and the total number of animals in each herd is stated. Dilutions of 1 in 10, 15, 20, 25, 30, 50, and 100 were used in each case.

Only one serum out of the 334 showed a water-clear reaction at 1 in 10. Five showed almost water-clear in the same strength and none showed even a trace of reaction at dilutions above 1 in 50.

From this Holtum concludes that a water-clear reaction at 1 in 15 probably indicates the presence of specific agglutinin.

"In all serological tests the arbitrary fixation of a border line, or belt between positive and negative reactions is inevitable, and the writer suggests that if water-clear reactions at 1 in 15 are regarded as being within that belt, like reactions at 1 in 20 should be considered as definitely due to the presence of specific agglutinins, as well as possibly to non-specific ones in a minor degree. For a variable period during the incubation of the disease, and also for a period during its decline, the specific agglutinins formed in the serum of an animal may be masked by the presence of the non-specific ones, and therefore a water-clear reaction at a dilution of say 1 in 10, may in some cases be due to the presence of the former, and in others to the presence of both, or to the latter only."

From this Holtum infers that it is not correct to consider that specific agglutinins only manifest themselves at dilutions of 1 in 20 or

higher, but the possible presence of non-specific agglutinins does not allow a definite diagnosis to be made on water-clear reactions in dilutions below this level. In these doubtful cases a re-test should be carried out in 14 days. A rise in the agglutinating titre after this interval is evidence of infection.

Holtum suggests the following routine. Dilutions of 1 in 15, 20, 40 and 60 should be used. A serum giving water-clear at 1 in 20 and almost clear at 1 in 40 should be considered positive even if the reaction is slight at 1 in 50. A serum giving water-clear at 1 in 20 and only negligible reactions at higher dilutions should be re-tested after a fortnight, as should also one giving water-clear at 1 in 15 with incomplete reactions at higher dilutions.

The existence of "inhibition zones" is of importance. Freshly drawn sera sometimes fail to produce agglutination in low dilutions. In cases in which the degree of agglutination does not run parallel with the gradations of dilution or where a series of "almost clear" reactions are given further tubes with higher dilutions of serum should be put up, to show whether there is an inhibition zone.

The diagnostic agent devised by Holtum for intradermal injection causes an animal to react as high as 1 in 25 in 14 days; this titre may persist for another fortnight and then decline.

McFadyean (J.). **The Reliability of the Agglutination Test for the Diagnosis of Contagious Abortion in Cattle.**—*Jl. Comp. Path. & Therap.* 1928. Dec. Vol. 41. No. 4. pp. 362–369.

This paper is a criticism of the results obtained by Holtum, who devised a double intradermal test for contagious abortion which was to be more satisfactory than the agglutination test, from the point of view of his results with the agglutination test. Holtum's views regarding the interpretation of the results of the agglutination test are at variance with those of the majority of investigators.

Paine (R.) & Martinaglia (G.). **Tuberculosis in Wild Buck living under Natural Conditions.**—*Jl. Comp. Path. & Therap.* 1929. Mar. 30. Vol. 42. No. 1. pp. 1–8. With 3 text figs.

The occurrence of tuberculosis in wild animals living under natural conditions is unique. The rare occurrence of tuberculosis in the sheep is generally attributed to the conditions under which this species lives, conditions which approximate to those of wild animals. But it would appear that environment alone is not sufficient to account for this comparative immunity.

The authors refer briefly to the scanty data available regarding the occurrence of tuberculosis in wild animals.

In South Africa the disease has been seen in the kudu (*Strepsiceros strepsiceros*) and the Cape duiker (*Sylvicapra grimmi*). It has been said that the disease has been seen in the bushbuck.

The country in which the cases have been found is rough hilly bush veld at an altitude of 1,400 to 2,000 feet. As the ground is stony and there is little or no grass or low-lying herbage, it is only lightly stocked. As a consequence the incidence of tuberculosis in domesticated animals is very low. Emphasis is laid on the fact that some farmers are unwilling to supply information regarding the health of their animals or to have cattle tested unless compensated for reactors slaughtered.

The authors give an example of what may be the true position as follows: A farmer who two years previously had lost two introduced bulls from what appeared to be tuberculosis had 18 cows and heifers tested. Four reacted. Two of these were found to have tuberculous lesions in the retropharyngeal glands. The other two have not been killed. This owner had 800 cattle running on 4,680 acres of bush country.

The first case in kudu was encountered in September, 1927. The glands about the throat were greatly enlarged and purulent. This case is suspected only, as no bacteriological examination was made.

A few days later a female kudu was shot. This was found to have caseation in pharyngeal glands, extensive pneumonia with caseous centres, advanced lesions in the bronchial, mediastinal, portal, and mesenteric glands. The prescapular and inguinal glands were enlarged but not recognizably diseased.

Material from a mesenteric gland was used for microscopic, cultural, and biological examination. Acid-fast bacilli were found, which were obtained in artificial culture and guineapigs and rabbits inoculated died of tuberculosis.

In December, 1927, a full-grown kudu bull was shot. The only abnormalities found were slight enlargement of the bronchial and mediastinal glands and a growth about 8 inches by 3½ under the longissimus dorsi muscle involving also the vertebrae and the intercostal lymphatic glands. Incision of one of these revealed dry caseous material. Guineapigs inoculated died of generalized tuberculosis. Cultures were obtained.

On June 19th, 1928, a kudu bull was shot which was found to have a swelling below the left ear (the figure shows it as being under the right ear). There was caseation of the lymph glands around the throat and areas of consolidation in the lungs, some of which were caseous. Guineapigs inoculated from lung material died of tuberculosis, and those inoculated with material from the pharyngeal glands were found to be tuberculous when killed at 6 weeks.

Cultures were obtained from the guineapig lesions.

On July 7th, 1928, a kudu cow was shot which showed a swelling as large as an egg in the left parotid region. Post-mortem examination revealed the presence of enlarged pharyngeal, mediastinal, mesenteric, and bronchial glands, areas of solidification in the lungs, caseation of the left prescapular gland and of the enlarged glands of the throat. Guineapig inoculation confirmed the diagnosis of tuberculosis.

On July 1st, 1928, a sick duiker ewe was caught, and it died the same evening. The lesions found were extreme emaciation, miliary tuberculosis of both lungs, pleurisy and peritonitis, lesions in the kidneys and liver, mediastinal, bronchial, portal, prescapular, mesenteric, crural, precrural, popliteal and pharyngeal glands.

Acid-fast bacilli were found, cultures were obtained, and rabbits and guineapigs inoculated developed tuberculosis. Microscopic examination of sections revealed the typical histological picture of tuberculosis. It appears to be probable that ingestion is the main method of infection, and it is suggested that the disease is spread by drinking from limited water supplies during drought. The cases have an importance from the public health aspect because a considerable amount of biltong (dried meat) is made from raw buck flesh.

From their cultural and biological tests the authors conclude that the organisms were tubercle bacilli of the bovine type.

IAKHNIS. La vaccination des nouveau-nés par le BCG d'après les documents de la Commission Ukrainienne. [**The Results of Vaccination of Newborn Children by B.C.G. as shown by the Ukrainian Commission.**]—*Ann. Inst. Pasteur.* 1929. Apr. Vol. 43. No. 4. pp. 399–419.

The total number of children vaccinated during 3 years with B.C.G. *per os* is 818. The author gives two reasons for this rather small number. In the first place it was decided in 1926 that the vaccination should be applied almost exclusively to children belonging to families in which the disease was known to exist, and secondly, it was desired to keep the vaccinated children under very close supervision, which would have been impossible had larger numbers been vaccinated.

The author deals with the organisation under which the vaccinations were carried out, the innocuousness of the vaccine used, the behaviour of the vaccinated children to infection with other diseases, the mortality of vaccinated children as compared with that of the non-vaccinated, and the reactions to tuberculin, etc.

It was found that vaccination *per os* with B.C.G. in no way affected the well-being of the children; the percentage of children whose development was slow did not exceed that of other children. There was no evidence that other diseases or repeated tuberculin tests resulted in any increase in the virulence of the bacilli ingested. There was no increase in mortality, and post-mortem examination of children dying of intercurrent diseases failed to furnish any evidence that the B.C.G. vaccine had produced any recognizable lesions. The author, therefore, concludes that the method is practicable and harmless.

Vaccinated children living apparently without contact with infection give in a considerable proportion of cases positive tuberculin reactions, but they appear to be subject to no rule. The reactions are always slight and show a tendency to disappear rapidly. They appear to depend upon the quantity of the vaccine actually penetrating the system.

Children in infected surroundings give, in a considerably larger proportion of cases, marked reactions to tuberculin from about 6 months onwards. The author believes that these are caused by infection with virulent bacilli. In spite of this, however, such children develop in a satisfactory manner. A small group of children in infected surroundings developed clinically recognizable infection, but this was of a benign type and affected the tracheo-bronchial glands.

Two important points must be borne in mind in connexion with vaccination. In the first place in vaccinating *per os* the amount of the vaccine absorbed may be insufficient, and secondly, the extreme difficulty of isolating children for the period required for the establishment of immunity. Possibly failures of the vaccination are in large measure explainable by one or both of these factors.

BASSET (J.) & DENIZOT (M.). Charbon bactéridien d'origine intestinale dans un troupeau de brebis. Remarques brèves sur la pathogénie et la prophylaxie du charbon. [**Anthrax of Intestinal Origin in a Flock of Sheep. Brief Notes on the Pathogenesis and Prophylaxis of Anthrax.**]—*Rev. Vét. et Jl. Méd. Vét.* 1929. Mar. Vol. 81. pp. 135–139.

The authors describe an outbreak of anthrax in sheep which were on land where no case of anthrax had been known for 20 years. They

had, however, been bedded upon straw which had had resting on it for several months sacks containing nitrate of soda. This bedding the sheep ate greedily. The authors believe that the nitrate of soda irritated the bowel walls and that anthrax spores in the intestinal canal then found a point of entry. The occurrence of a number of cases of abortion in the flock is also attributed to the ingestion of the nitrate of soda.

It having been established that anthrax was the cause of death, vaccination was suggested, but the owner refused to have either serum or vaccine used. No further cases occurred. The authors note that had either serum or vaccine been used they would no doubt have been given the credit for the arrest of the outbreak. The authors express the view that in countries where anthrax is widespread it is not necessary to use serum prior to vaccination. Serum cannot protect against latent infection (spores in the intestinal contents) and the passive immunity does not last sufficiently long to allow active immunity to be established while it is still effective. It is preferable to vaccinate and then keep strict supervision over the flock until immunity is established.

GRIERSON (A. M. M.). **Experimental Observations on Anthrax Infection and Anti-Anthrax Immunisation.**—*Jl. Comp. Path. & Therap.* 1929. Mar. Vol. 42. No. 1. pp. 8–24.

While the subcutaneous method of vaccination can be used for the larger susceptible animals it often fails with rabbits and guineapigs. The author summarizes briefly BESREDKA'S views regarding local immunization and cutaneous infection, and the results obtained by a number of investigators who have undertaken experiments designed to check his views.

Grierson gives details of an experiment which confirms the view to a certain extent that small animals fail to contact anthrax when the organism is introduced into their body or tissues without any wounding of the skin or surface of the alimentary tract. Six guineapigs were fed daily with bran mixed with an emulsion of anthrax bacilli. Two died after 10 days and the organism was isolated in pure culture from the heart blood. The feeding of the survivors continued and a week later a small amount of blood was withdrawn by heart puncture and sown only in broth. Pure cultures were obtained and the guineapigs died within 4 days of the removal of the blood from the heart. In only two of them were there lesions typical of anthrax. There was no special formation of oedema at the point of entry of the needle. The two other animals showed no obvious lesions. It would appear that the factor determining the fatal infection after a period of many days with the organism in the circulating blood is in some way connected with the trauma produced by the operation of heart puncture, which favours rapid germination of the spores in the blood. It does not necessarily indicate contamination and infection of the subcutaneous tissues at the point of penetration of the needle.

It is generally agreed that immunization can be established by the cutaneous path, and further that no antibodies can be demonstrated in the blood of an animal so immunized.

The author details experiments carried out with vaccines obtained from BESREDKA. The technique employed in testing these was that described in his original paper. The results showed that whether the vaccines be applied to shaved skin or by intracutaneous inoculation

complete failure may result. Many guineapigs survived the "first" vaccine, but all the animals died when only small quantities of second vaccine were introduced into the skin.

Of 8 rabbits immunized by the cutaneous path one died after receiving 1 cc. of virulent anthrax bacilli and one three days after the injection of the "second" vaccine. It is possible that some of the material entered the subcutaneous tissue in these cases. The surviving rabbits, with one exception, received numerous injections of virulent anthrax bacilli without ill-effects. Detailed histories of these animals are given.

To test the properties of sera from immunized animals a fixed quantity of the serum (1 cc.) was injected along with a fixed quantity (0·5 cc.) of decimal dilutions of an emulsion of the anthrax bacillus into mice. A control with emulsion of the same strength but without serum was inoculated at the same time. The dilutions ranged from $1:10^3$ to $1:10^{13}$ None of the mice injected with serum and emulsion outlived the controls for any length of time. The experiment was repeated and was also carried out with Sclavo's serum with the same result.

Immunity against anthrax is at present not capable of explanation. Little or nothing is known regarding the offensive mechanism of the organism. Some investigators hold that the skin susceptibility to anthrax is not specific as claimed by BESREDKA. These believe, and the author is inclined to agree with them, that any area which has a comparatively poor blood supply is susceptible to infection, and that this susceptibility is due to a relative absence of protective cells and fluids which allows the organism to modify or adapt itself either by capsule or aggressive formation, and so invade the rest of the body.

Without doubt BESREDKA'S method of immunization gives satisfactory results with the larger animals, and the immunity is superior to that obtained by subcutaneous inoculation, and, moreover, it is safer. The author briefly refers to the work of KRAUS and BELTRAMI regarding the protective powers exercised by normal ox serum in anthrax experiments with rabbits, and suggests that such protection must be non-specific and must depend upon the injection of alien serum.

MAZZUCCHI (M.). Risultati di un nuovo metodo di vaccinazione anticarbonchiosa con alte dosi di germi e di spore virulenti. [**Results of a New Method of vaccinating against Anthrax with Large Doses of Virulent Bacilli and Spores.**]—*La Clin. Vet.* 1929. Apr. Vol. 42. No. 4. pp. 201–213. With 3 figs. on 2 plates.

The author does not publish in this paper any details of the method of preparation of his vaccine. An account of this is promised in another paper, and he deals in a general way only with the results obtained.

BROUDIN (L.). Sur l'importance du pH dans la lyse des Pasteurellae du barbone et du choléra aviaire. [**The Importance of the Reaction of the Medium in the Lysis of the Pasteurellas of Barbone and Fowl Cholera.**]—*Bull. Soc. Path. Exot.* 1929. Apr. 10. Vol. 22. No. 4. pp. 245–246.

The bacteriophages of these organisms have been under investigation at Saigon for the last 10 years. Since 1920 70,000 doses of anti-barbone vaccine have been used for experimental purposes, and since 1925 about 5,000 doses of anti-fowl cholera vaccine have been used for

the same purpose. Long experience in the preparation of vaccines by lysis has enabled the author to determine the optimal conditions for its action; at least as regards the particular strains of bacteriophage employed.

i. *Barbone.*—Perfect lysis is regularly obtained with the following technique. Buffalo broth prepared with Martin's peptone and corrected to pH 7·2 to 8·2 is inoculated and 7 hours later 0·5 cc. of bacteriophage and an equal amount of the same bouillon are added. The following day the flasks are all perfectly limpid, while the control flask (without bacteriophage) shows marked turbidity. The vaccine is filtered through an L3 candle and ampouled and these are sealed after incubation for 24 hours.

ii. *Fowl Cholera.*—Peptone quite free from sugar must be used because the production of acid hinders lysis. The reaction of the medium must be strictly 8·5. Special care must be taken in cleansing all glass-ware or this pH value may be disturbed. Either beef or chicken broth can be used, but the author prefers the latter.

In order to avoid variations of pH caused by precipitations and sterilization, the broth is buffered before precipitation and correction of the reaction by soda with 20 cc. per litre of a 2·5 per cent. solution of mono potassium phosphate. In order to get the exact pH the reaction must be corrected before precipitation and also before sterilization.

When the exact reaction has been obtained and before sterilization the broth is distributed into tubes in 10 cc. amounts. A fresh correction must be made after sterilization. The pH often falls to 8·3 or 8·4. One tube is used to test the pH and the amount of N/10 soda necessary for correction is added to the other tubes.

The vaccine is prepared in the same way as the barbone vaccine.

TURNER (A. W.). **Infectious Necrotic Hepatitis (Black Disease), caused by** *B. oedematiens* **in a Cow.**—*Austral. Vet. Jl.* 1929. Mar. Vol. 5. No. 1. pp. 11–17. With 3 text figs.

The purpose of this note is to describe what appears to be the first recorded case in an animal other than the sheep of a fatal disease associated with (*a*) the presence in the liver of necrotic foci containing *B. oedematiens*, (*b*) the infestation of the liver at some time with *Fasciola hepatica*, and (*c*) the occurrence of serous effusions, particularly of the pericardial sac.

The subject was a seven-year-old Jersey cow calved two or three months previously. Symptoms of ill-health appeared only a few hours before death. These were dyspnoea and uneasiness, but there was no rise of temperature (maximum recorded 101·4°).

At post-mortem examination the following conditions were found. Omentum slightly injected, amber-coloured fluid in the peritoneum, areas of necrosis in the liver. Pleural cavity 300 cc. of fluid, pericardium 400–500 cc. Intramuscular and sub-endocardial haemorrhages in the heart.

Detailed examination of the liver (sent whole to the laboratory in 10 per cent. formalin). Necrotic areas were discoverable and the thickened bile ducts indicated a previous infestation with flukes, but none could be found at the moment.

Throughout the fixed and unfixed (deeper) parts of the liver a bacillus with the morphological characters of *B. oedematiens* could be found. The organism could not be detected in the properly fixed tissue outside

the necrotic areas. The organism had, however, invaded and multiplied in the deeper unfixed tissue. A marked feature of the sections was lymphangiectasis. Cultures from the deeper parts of the liver tissue, both necrotic and unaltered, developed a bacillus in a state of purity.

This bacillus when stained by Gram's method was found to be from about 6 to 9$\mu$ in length, by 1 to 1·9$\mu$ in thickness. Spores were oval and subterminal. Large peritrichous flagella could be demonstrated. There was a tendency for the bacillus to become decolourized irregularly in preparations stained by Gram. Long filaments could be found. Filtered liquid cultures contained a toxin which killed guinea-pigs in 36 to 40 hours in a dose of $\frac{1}{50}$ cc. The post-mortem findings were subcutanoues congestion with a large amount of clear rose-coloured gelatinous oedema. Congestion of the ileum and stomach. Slight congestion of the kidneys, adrenals, bladder, haemorrhages in the lungs. Doses of $\frac{1}{100}$ to $\frac{1}{200}$ cc. cause oedema which is absorbed and recovery takes place.

Acid is produced with glucose and glycerin. No acid is produced with laevulose, galactose, saccharose, lactose, maltose, inulin, mannite, dulcite and salicin.

The bacillus is faintly haemolytic. Toxin is completely neutralized by anti-oedematiens serum.

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WOLLMAN (E.). Quelques considérations sur la bactériophagie. (Théorie de l'autolyse et théorie des facteurs héréditaires.) [**Bacteriophagia. The Theory of Autolysis and the Theory of Hereditary Factors.**]—*Ann. Inst. Pasteur.* 1929. Mar. Vol. 43. No. 3. pp. 359–368.

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## DISEASES DUE TO FILTERABLE VIRUSES.

PONOMAREFF (A. W.) & SOLOVIEFF (N. N.). Nouveau procédé de la préparation du vaccin antirabique et essai d'application de ce vaccin pour l'obtention d'un sérum antirabique de haute activité. [**A New Method of preparing a Rabies Vaccine, and the Use of this Vaccine for the Production of an Anti-rabic Serum of High Value.**] —*Ann. Inst. Pasteur.* 1928. Dec. Vol. 42. No. 12. pp. 1661–1671.

The authors hold that all anti-rabic vaccines produced hitherto possess one defect in common, namely, the presence in them of nerve tissue [their own statement is that they contain cerebral tissue]. They therefore propose to prepare vaccine which contains none.

The brain of a rabbit dead of fixed virus is reduced to a fine emulsion in 10 volumes of physiological salt solution. This is left standing on ice for several hours. The supernatant liquid is poured off and mixed with one quarter its volume of liquid paraffin. The mixture is placed in a shaking machine for one or more hours. This breaks up the paraffin into minute droplets. Then the mixture is centrifuged for half an hour. This results in the precipitation of some of the particles of nerve tissue, while others are carried up to the top among the globules of oil. Between the two is a slightly opalescent liquid, and this is carefully pipetted off. This is again diluted to 1 per cent. (that is, 1 per 1,000 of the original brain tissue) and this dilution kills rabbits by subdural inoculation. The minimal fatal dose of the

fixed virus used is 1 in 2,000, therefore the suspension of virus is practically as virulent as the original material. It is argued that if there is little modification of virulence of the virus after this treatment its antigenic properties should not be altered.

The authors have carried out experiments for the immunization of rabbits and dogs with the product as it is, and also after heating to 55–58° C. for half an hour, and after the addition of carbolic acid. These experiments are not yet complete, but the authors claim to have immunized a horse with the vaccine and to have obtained an anti-rabic serum of very high rabicidal titre.

The authors have tried ether in place of liquid paraffin and they say that this treatment gives " more precise results," but the liquid obtained after the centrifuging is, they say, not virulent.

Although the authors state that they have immunized a horse with a vaccine prepared in the way stated, it would appear that " during the first period of immunization, which lasted two months, the horse was injected with 10 per cent. emulsions of 10 brains of rabbits dead of fixed virus, the emulsions having been passed simply through filter paper. The injections which were given in increasing doses were by the subcutaneous path, at intervals of 4 or 5 days." Rabbits inoculated with serum drawn from the horse up to 22 days after immunization died as the result of the presence of neuro-toxins in the serum. Before continuing the immunization, therefore, the authors waited for a time. Serum drawn on the 69th day injected subdurally into rabbits produced no neuro-toxic effects. In view of the greater toxicity of heterologous materials when injected the authors used fixed virus from the brain of a horse for the immunization of horses. The animals were inoculated suboccipitally and typical symptoms of infection began to appear on the 5th day, and death took place on the 8th day.

A test of the virulence of the brain tissue showed 1 drop of a 1 per 1,000 dilution was the minimal lethal dose for rabbits.

The brains were treated by the paraffin method described above, and increasing doses were injected subcutaneously during a period of 6 weeks. In all, the hyperimmunized horse received the equivalent of 2 equine brains (1,300g.). Two weeks after the last inoculation blood was withdrawn, and was proved to be free from neuro-toxins by the subdural inoculation of rabbits.

When tested against emulsion of fixed virus which had been filtered through gauze (1 per cent. suspension of brain) the serum was found to produce neutralization in dilutions of 1 in 1,000 and 1 in 3,000. The same emulsion filtered through paper was neutralized by the serum in 1 in 20,000 and 1 in 50,000. The mixtures of emulsion of fixed virus and serum were, in most cases, kept on ice for 24 hours before they were injected.

A considerable number (about 100) animals have been used to test the effect of the intravenous injection of 10 cc. of the hyperimmune serum 24 and 4 hours prior to the subdural injection of one or two lethal doses of fixed virus. About 50 per cent. were protected, while the remainder developed the disease after a period of incubation which was longer than in the case of the controls.

With double the dose of serum injected 4 hours before subdural inoculation with fixed virus 70 per cent. of rabbits resisted infection. Experiments in which the serum is injected after inoculation with virus are being carried out.

SERRA (A.). Lesioni miocardiche nella rabbia. [**Myocarditis in Rabies.**]—*La Clin. Vet.* 1928. July. Vol. 51. No. 7. pp. 408–414. With 3 figs. on 1 plate.

The virus of rabies may cause both a parenchymatous and an interstitial myocarditis.

MINETT (F. C.). **Disinfection in Foot and Mouth Disease.**—*Jl. Comp. Path. & Therap.* 1928. Dec. Vol. 41. No. 4. pp. 298–317.

This paper is divided into five sections dealing with : (i) The action of various reagents on filtered vesicle fluid from guineapig lesions ; (ii) the action of reagents upon the virus in the presence of added organic matter ; (iii) the time factor in disinfection ; (iv) disinfection of dried virus on various substrata ; (v) the disinfection of hay, hides and manure. It gives at rather greater length the observations recorded in the Second and Third Progress Reports of the Foot and Mouth Disease Research Committee.

The main object of the work was to accumulate data which might form a basis for practical methods of disinfection in foot and mouth disease. As it was not possible to carry out the experiments with cattle virus under field conditions the observations have to be regarded, to some extent, as preliminary. In Section I the results were as follows. Diluted and filtered guineapig lymph was used, and it was found that chlorine, iodine, potassium permanganate, sodium bisulphite, and certain salts of copper were active in high dilution. Phenol, cresol, and their sulphuric derivatives have a very low activity. The apparently low activity of formalin and mercuric chloride is in reality due to their slowness of action. Sodium hydrate is uniformly active up to 1 in 20,000. On the other hand, when sulphuric acid is mixed with the virus the evidence points to the existence of a zone of low concentration which causes complete destruction, certain higher concentrations than this failing to do so. Similar results were obtained with hydrochloric acid. Destruction was uniformly complete up to a concentration between N/8 and N/12, between N/12 and N/150 it was incomplete, and at N/800 there was a suggestion of increased disinfecting activity.

The virus is destroyed during 24 hours' exposure to buffer solutions of pH 6·0 and below and to alkaline buffer solutions of pH 10·0. Experiments with reagents which denature protein (alcohol, acids, tin methyl iodide) afford some support but do not prove the exactitude of the protein precipitation hypothesis of OLITSKY and BOËZ. The addition of minimal amounts of sodium hydrate to alcohol appeared to increase its virucidal properties, but there was no such evidence in the case of phenol.

Section II. When saliva and faeces were added to the virus it was found that formalin was active to a concentration of at least 1 in 600. Caustic soda was effective up to at least 1 in 800. Hydrochloric acid was less active than sulphuric acid. Antiformin appeared to depend for its action entirely upon its content of caustic alkali. Bichloride of copper was effective to 1 in 200, copper sulphate and zinc salts to about 1 in 100 and perchloride of mercury to 1 in 250. The action of phenol and cresol was not affected by the presence of protein, but that of chlorine and potassium permanganate was greatly reduced. The addition of hydrochloric acid appeared to increase the efficacy of perchloride of mercury.

Section III. In the case of copper sulphate, zinc chloride and sodium hydrate the initial concentration of the agent is the important factor. If this falls below a definite level prolonged action does not lead to complete disinfection. In the case of formalin and of perchloride of mercury the time factor is important, as these substances produce their effects slowly. While formalin 1 in 600 destroys the virus in faeces in 24 hours, 1 in 60 does not destroy it in an hour. In the case of filtered virus a concentration of 1 in 50 causes complete destruction in 3 hours, but a dilution of 1 in 450 is effective in 24 hours, and a concentration of 1 in 3,500 often destroys all or nearly all the virus in 3 days. A concentration of 1 in 250 perchloride of mercury is required to effect sterilization in 3 hours, but with the time extended to 3 to 6 days 1 in 25,000 to 1 in 100,000 concentrations are effective.

Section IV. Caustic soda has been recommended as an inexpensive and efficient disinfectant for the virus, but it has certain disadvantages. Absorption of carbon dioxide with the formation of carbonate reduces its action, and it has a destructive effect upon commonly used protective substances such as tar. It also has a marked effect upon the skin. From a general point of view formalin is considered to be more suitable than caustic soda. It is said that the effects of formalin upon the skin can be avoided by the addition of small amounts of alcoholic soap. Such disinfectants are obtainable in commerce.

Spraying may not be very effective for the disinfection of dried material, but possibly fumigation with formalin in a moist atmosphere may prove to be effective.

Section V. It has been shown that the virus may survive in hay for considerable periods, but it has also been shown that formalin is effective for the destruction of the virus on hay. 1 in 1,000 formalin sprayed on hay and allowed to evaporate destroys the virus, possibly because of increasing concentration with evaporation.

In the absence of experiments with cattle it may be held that spraying hay with 1 per cent. formalin is a reliable field method of disinfecting hay.

One per cent. formalin acting for 24 to 48 hours was effective for the destruction of virus in infective epithelium or blood clots smeared on guineapig hides. Further research is necessary, as there are objections to the use of formalin from the trade point of view. Infective epithelium buried in fresh cattle manure became innocuous in four days.

BEATTIE (J. M.), MORCOS (Z.) & PEDEN (D.). **i. Transmission of Foot-and-Mouth Disease in Rodents by Contact. ii. The Spread of Foot-and-Mouth Disease by Rats, Rabbits, and Birds.**—*Jl. Comp. Path. & Therap.* 1928. Dec. Vol. 41. No. 4. pp. 353–362. With 1 text fig.

The authors state that in the course of their work they have noted a considerable number of contact infections and they have carried out a series of experiments to determine if this is of common occurrence. Their methods have included (*a*) placing animals together in a cage, (*b*) placing animals in cages with the feet of killed infected animals, (*c*) placing animals in cages previously occupied by infected animals.

Details of four series of experiments are given, and the results appear to show that unless there is an abrasion of the skin or mucous membrane, infection does not take place either by contact or through ordinary feeding.

In earlier experiments the proportion of infection by contact was higher, and a more critical examination of the previous experiments proves that in a small proportion of the so-called " contact-infection " feeding may have played some part.

In the second part of the paper the question of the importance of abrasions is also considered.

The authors quote at some length from the Reports of the Research Committee to the general effect that there are no real grounds for supporting the view that rodents and birds play any part in the spread of foot and mouth disease. They claim that the reports establish their original statement that rats can become infected with foot and mouth disease.

Details of experiments with rats are given, and it is concluded that white rats, although resistant to the virus, can be infected. There may be no lesions, but the virus may be transmissible by inoculation from them to other animals.

Fifty-nine wild rats were fed on the organs or tissues of infected guineapigs and 16 were inoculated intradermally or vaccinated. The virus was a definite guineapig virus. Of the first batch 21 showed definite lesions and 3 of the 16 were obviously infected.

The results of these experiments together with those obtained with rabbits indicate that rats and rabbits can become infected and may show characteristic lesions, but an abraded surface appears to be essential. Such abrasions are very common in wild rats. Of rats from ships or warehouses anything from 20 to 40 per cent. show definite abrasions. Rats are commonly cannibalistic and thus the virus may be transmitted, and, further, the virus from infected rats on a farm may readily infect feeding stuffs.

JACOTOT (H.). Sur l'état d'infection inapparente dans la peste bovine. Conséquences épidémiologiques possibles. [**The Condition of Inapparent Infection in Rinderpest.**]—*Bull. Soc. Path. Exot.* 1929. Apr. 10. Vol. 22. No. 4. pp. 239–241.

The idea of inapparent infection was first introduced by NICOLLE & LEBAILLY some years ago. They showed that in both rats and guineapigs exanthematous typhus may develop without evident symptoms in experimentally infected animals.

Recently BLANC, CAMINOPETROS and MANOUSSAKIS have suggested that in the human subject cases of dengue may occur without recognizable symptoms, but the blood is virulent. Such attacks confer immunity.

An Indian goat was inoculated with virulent blood, but showed no evidence of disturbance of health of any kind—no loss of appetite and no rise of temperature. Its blood, taken on the 4th and 5th days, caused fatal rinderpest in a calf, and blood taken on the 7th and 8th days also caused infection in a calf.

A similar result was obtained with a sheep experimentally infected. Its blood taken daily from the 5th to the 11th day injected into a calf produced fatal rinderpest. The sheep showed no disturbance of health whatsoever.

Animals infected experimentally may fail to show any evidence of infection as a result of treatment. Of this the author gives an example of a calf which was given 1 cc. of virulent blood and at the same time 90 cc. of anti-rinderpest serum. There was no evidence of infection,

but blood taken on the 6th and 7th days caused severe rinderpest in another calf. [It has long been known that a rinderpest reaction can be "blocked out" by a suitable dose of serum, and that immunity is nevertheless established.] A second example is that of a calf which was inoculated with a "pulp" of lung in October, 1927. In January, 1928, it was tested with an inoculation of virulent blood. There was no reaction. It is said that the "vaccination" was effective. Blood taken from the calf on the 7th day after the test inoculation produced fatal rinderpest in another animal.

The author thinks that animals which can become infected without showing any evidence of the disease may be of no inconsiderable importance in the spread of rinderpest.

Jacotot (H.). Sur les formes de l'immunité dans la peste bovine. [**The Types of Immunity in Rinderpest.**]—*Bull. Soc. Path. Exot.* 1929. Apr. 10. Vol. 22. No. 4. pp. 242–245.

The author feels that some revision is necessary of the classification of the types of immunity occurring naturally or produced artificially in animals. The present classification is, he thinks, too restricted. His studies of the manner in which animals react both under natural conditions and after experimental intervention induce him to classify the immunity of animals against rinderpest under two heads. In the first group he places animals which, when subjected to contact with the disease, become infected but show no evident symptoms of such infection. This immunity he describes as "arresting immunity" (immunité empêchante).

In the second group he includes animals which, when placed in contact with the disease, not only fail to develop any symptoms but actually resist the establishment of the virus in their bodies. Such animals possess a "sterilizing immunity." Arresting immunity is classified as natural and acquired. Natural arresting immunity is seen in susceptible species in the majority of members of certain breeds which are considered as refractory. Acquired arresting immunity is that which can be conferred upon animals by the use of protective serum, and it also results from vaccination with the pulp of organs.

Sterilizing immunity may also be natural or acquired. Natural sterilizing immunity is seen in species absolutely refractory to rinderpest. Acquired sterilizing immunity is developed in a susceptible subject as a result of an attack of the disease.

Sterilizing immunity is a stable condition, but arresting immunity is frequently transient and almost always, so to speak, accidental. The serum-simultaneous inoculation method is of extreme value, but it has disadvantages. On the other hand, the recently introduced vaccination by means of the pulp of organs has the advantage over the former method in that it is absolutely free from risk, but it confers only a temporary and apparent resistance. Inoculation with virus following vaccination with organ pulp would seem in some instances to convert an "arresting immunity" into a "sterilizing immunity."

Tarantino (G. B.). Peste bovina. [**Cattle Plague.**]—*La Clin. Vet.* 1928. Dec. Vol. 51. No. 12. pp. 739–745.

Cattle plague is known as gulhai in Eritrea and as furuc in Somaliland. According to the natives, the mortality ranges from 80 to 90 per cent. Calves born of immune cattle are said to be immune until they are weaned (5–6 months).

FUTAMURA (H.). **The Morphological Study of the Virus of Bovine Contagious Pleuro-Pneumonia.**—*Jl. Jap. Soc. Vet. Sci.* 1929. Mar. Vol. 8. No. 1. pp. 39–48. With 24 figs. on 2 plates.

The author describes a modification of Hazato's technique for staining the organism of contagious bovine pleuro-pneumonia.

Fifteen strains of virus have been used. The majority of these have been isolated in Japan, and have passed through from 6 to 37 generations. One was obtained from a pleuro-pneumonia vaccine of German origin.

As culture media broth adjusted to pH 7·5 with serum from various species of animals in proportion ranging from 2 to 20 per cent. and in some instances 0·5 per cent. of glucose. Solid agar containing 10 per cent. ox or horse serum was also used.

Strains were cultivated and selected luxurious growths were examined at definite intervals for a month. Parallel broth tubes, uninoculated, were examined at the same time as controls. Films were examined stained and by dark ground illumination.

The method of staining is as follows :—

1. Thick films are made from cultures.
2. These are air dried and " fixed in the usual manner."
3. Immerse in 5 per cent. chromic acid for 3 minutes.
4. Wash thoroughly in water.
5. Stain with dilute Giemsa (1·2 to 1·4 cc. of Giemsa in 30–40 cc. of distilled water) for 1–3 hours at room temperature and follow this by keeping the preparations at 5 to 7° C. for 15–20 hours, or alternatively place them in Giemsa (0·9 cc. to 30–40 cc. of distilled water) for 40 hours at 5–7° C.
6. Wash, dry and mount.

The author finds that the virus is pleomorphic. At first the organism appears as minute round structures 0·1 to 0·2$\mu$ in diameter. After about 3 days filamentous forms up to 5$\mu$ appear and these develop a series of rounded granules in their interior. Later these coccoid forms are liberated from the filaments and develop into vibrio-like and coccobacillary forms. The author describes some of the vibrio-forms as having a spherical body with one or two flagella. Spiral and comma-shaped forms are also found.

Some of the forms appeared to be enclosed in an irregular capsule which retained the stain only faintly. After 7 to 14 days cultivation all forms acquire a spherical shape and they appear to decrease in numbers. The author suggests the possibility that two types of virus are developed at this stage—one which is represented by the coccus-like forms and one which is ultra-microscopic ; and the results of some experiments in which filtered and unfiltered broth cultures were used for sub-cultures are briefly stated to support this view.

The addition of serum, preferably sheep serum, and glucose to culture media improved their value.

LAGRANGE (E.). Une nouvelle maladie des poules à virus filtrable observée en Egypte. [**A New Disease of Poultry caused by a Filtrable Virus observed in Egypt.**]—*Bull. Soc. Path. Exot.* 1929. Feb. 13. Vol. 22. No. 2. pp. 64–68.

The disease referred to in this paper is said to differ from the classical fowl plague ; it occurs only in fowls, to the exclusion of the other birds of the farm. It is fatal within 2 days in experimental cases, whereas

fowl plague requires 4 to 8 days to produce a fatal result. It is said that the disease appears to be distinct from Newcastle disease described by DOYLE. The respiratory symptoms are not observed as a rule (they have been seen in one case only). The Newcastle virus can be diluted to a greater extent than the Egyptian virus without losing its capacity to kill. The pigeon appears to be refractory to the Egyptian virus. Lagrange has found very marked sero-fibrinous pericarditis in about 50 per cent. of cases. The disease of poultry described as occurring in Java appears to be a different condition also.

## MYCOTIC DISEASES.

OEHL. Lymphangitis epizootica beim Schwein. [**Epizootic Lymphangitis in the Pig.**]—*Deut. Tierärzt. Woch.* 1929. Jan. 19. Vol. 37. No. 3. pp. 39–40.

The author describes a case of epizootic lymphangitis in a pig. The animal showed a number of abscesses and cording of the lymphatics. On post-mortem examination abscesses were found in the lungs and in the bronchial glands. Smears of the pus were found to contain the Cryptococcus. No explanation of the manner in which the pig acquired the infection could be found.

BILTRIS (R.). Sur la variabilité des caractères de l'espèce chez les dermatophytes. [**The Variability of the Characters of the Dermatophytes.**]—*Ann. Inst. Pasteur.* 1929. Mar. Vol. 43. No. 3. pp. 281–358. With 15 plates.

The author deals at considerable length with the basis of the system of classification of the Dermatophytes, and he concludes that it is insecure because its essential factor is the constancy of cultural character. He holds that the division of the Trichophyta into a large number of different species, which is based upon cultural characteristics, is not supported by the facts. A future development of the system of classification is one involving great simplification, with a marked reduction in the number of species. The reaction of the medium used is probably an important factor in determining cultural characters.

## MISCELLANEOUS.

ROMARY (A.). Le 914, comme adjuvant de certains traitements chimiques ou sériques des animaux en Indo-Chine. [**914, as an Adjuvant to Certain Chemical or Serum Treatments of Animals in Indo-China.**]—*Bull. Soc. Path. Exot.* 1929. Mar. 13. Vol. 22. No. 3. pp. 166–168.

In this brief paper the author states that he has had good results in the treatment of osteomalacia in equines, summer sores, mange and eczema in horses and dogs, parasitic enteritis, particularly infestations of horses with ascarides, distemper, equine typhoid, and severe anaemia with 914.

He feels convinced that it would be an advantage to inject 914 prior to giving rinderpest serum.

He gives a brief account of a single case of equine surra in which two injections of 914 were given at an interval of a few days, followed by

injection of 309. Complete recovery resulted. Doses, etc., are not specified.

STEWART (J. R.). **Swelled Head in Ram Lambs.**—*Australian Vet. Jl.* 1929. Mar. Vol. 5. No. 1. pp. 23–26.

The author believes that the condition affects ram lambs only, and between the ages of 6 and 20 months. He doubts whether the cases described as occurring in ewes and wethers are really the same condition. The disease runs its course in two or three days and the majority of affected animals die.

On the property where the experiments were conducted the ram lambs were affected in a certain paddock. They were then removed and the ewe lambs of the same crop were placed in it. No cases appeared. The ewe lambs were then replaced again by the ram lambs, and the disease continued among them. When they were again removed and replaced by other sheep no deaths occurred among these.

The disease occurs every year on this property among ram lambs, and it is improbable that the disease is carried over from year to year because the ram lambs of one year do not come into contact with the sheep of the year before.

The disease runs from November to March and it always makes its appearance when feeding is good. Shifting affected lambs from paddock to paddock put no check on the disease.

The first sign is slight oedema of the lower eyelid and chin. This rapidly increases until at 12 to 24 hours the head may be twice the normal size. Purulent conjunctivitis often occurs. As the tip of the nose does not swell, breathing is not restricted. The swelling of the tissues hinders normal eating and drinking. There is marked uneasiness, and the temperature may be raised. In a proportion of cases the oedema may extend to the neck. As a rule, the ears are not involved, and can be moved readily by the animal.

There is no evidence of a wound or contusion. At post-mortem examination the lesions appear to be confined practically to the head, although the liver is often rather brown in colour, and there may be an icteric condition of the skin. The swelling is due to saturation of the connective tissues with a perfectly clear amber-coloured serous exudate. The muscular tissue is not involved.

No organism that can be causally connected with the disease has been recovered. Blood serum from a recovered ram injected in doses of 20 to 40 cc. every 8 hours effected a cure in 24 to 36 hours. The same curative effect, however, was obtained with normal sheep serum. Medicinally, saline enemata should be given every 4 hours.

The author thinks the condition is connected with the development of the sex glands. He therefore suggested giving the ram lambs ewes.

A 100 ram lambs were put with 200 cross-bred ewes. "The results were 100 per cent. lambs." No case of swelled head occurred.

ALBISTON (H. E.). **Jaundice in Sheep.**—*Australian Vet. Jl.* 1929. Mar. Vol. 5. No. 1. pp. 26–29.

The author describes an acute fatal jaundice occurring among a flock of 400 sheep grazing on river flat pastures. Removal of the flock to higher ground failed to check the disease, but it did not spread to other animals, which had been grazing the higher ground and with which they were mixed.

The characters of the condition were as follows: Sterterous breathing, anaemia, jaundice, copious yellow discharge from the nostrils, blood flecks in rather fluid faeces. Temperature about 104 to 105° F.

Blood withdrawn from the jugular before death clotted normally, but the serum was tinged with green. The haemoglobin content was 50 to 55 per cent. (normal sheep at the laboratory gave 85 to 100 per cent.). Red cell count was a little over half the normal. Microscopic examination showed evidence of profound anaemia. No differential leucocyte count was made.

Examination of the blood showed that it gave a strong delayed Van Bergh test, indicating haemolytic jaundice. The urine contained bile salts and pigments and traces of albumen.

The liver was enlarged, brownish-red and cirrhotic. The kidneys were slightly enlarged, deep brown in colour, with tubules showing as darker lines radiating through the medulla and boundary layer. The only lesion found in the alimentary tract was the presence of capillary haemorrhages in the mucous membrane of the colon. Microscopic examination showed a deposition of bile pigments in the bile ducts and bile capillaries. There was some fatty infiltration. In sections from the kidneys the cells of the convoluted tubes were found to be packed with brown granular bile pigment, the collecting tubes containing a considerable amount of brownish granular débris.

Cultural examination was negative, except for a bacillus recovered from the kidney which was non-pathogenic for rabbits and guineapigs.

Intravenous injection of a large amount of blood failed to set up the disease. Feeding with material from the alimentary tract also failed to cause any disturbance of health.

The nature of the condition was not established.

Das (P. N.). **Nasal Granuloma of Cattle in Bihar and Orissa.—Experiments regarding Mode of Infection and Treatment.**—*Jl. Comp. Path. & Therap.* 1929. Mar. Vol. 42. No. 1. pp. 24–33.

This disease is generally known as "Nakhra" or "Sinsunia," signifying a disease of the nostrils. It has been held that neither surgical intervention nor medicinal treatment is of any value, but a few records have appeared regarding treatment with tartar emetic, and in some of these very strikingly successful results are claimed.

An enquiry into the incidence of the disease in Bihar and Orissa in 1924 resulted in the reporting of 1,513 cases. Seventy-one of these were treated with intravenous injections of tartar emetic in doses ranging from 10 to 20 grains in 20 cc. of distilled water. In one village the animals treated each received five injections, in four others two or three injections were given, and in one not more than one. The cases receiving five injections were either cured or greatly improved in condition, while small numbers of doses appeared to be of little or no lasting benefit. It is not yet known whether the apparent cures are actually complete or not.

With a view to studying the method of infection and the treatment of the disease a series of experiments was carried out with five healthy and eight diseased cattle. The experiments extended over a period of nine months—from March to December, 1924.

A series of experiments was also carried out at Bankipur with a view to determining the method of infection. In these experiments feeding

and watering diseased and healthy together, rubbing material from a lesion on to scarified nasal mucous membrane, the subcutaneous injection of material from a lesion on both sides of the nasal peak of healthy animals, submucous and intravenous injections of material, and the use of nose strings from diseased animals on healthy animals were all tried, each on a small scale, but in no case was the disease transmitted.

Treatment.—Two animals suffering from the disease were given weekly intravenous injections of 5 and 10 grains of potassium iodide. The treatment was continued until 140 and 70 grains respectively had been given. There was no improvement. Tartar emetic was used in different ways in a small number of cases.

The first case received 5 grain doses in 30 cc. of distilled water with 2-day intervals. 34 doses were thus given. It was cured and discharged 3 months after the treatment stopped (and 7 months after it had been begun).

In the second case the disease was not at a very advanced stage and 10 grain doses were given at intervals of 7 days. 14 injections were given and a cure resulted.

Case 3 was given 12 grain doses with 11-day intervals. When 9 doses had been given all recognizable evidence of the disease had disappeared. Two months later there was slight ulceration of the nasal mucous membrane. As the administration of two doses at an interval of 4 days produced no improvement, 9 doses of 10 grains were given on alternate days. This apparently effected a cure. The fourth case was cured by 8 injections of 10 grains at intervals of a fortnight.

Cases which potassium iodide had failed to influence favourably were subsequently cured by courses of injections with tartar emetic.

GALOUZO (I. G.). Ein Beitrag zur Haematologie der turkestanischen Dromedare. [**The Haematology of the Dromedary of Turkestan.**] —*Berlin. Tierärzt. Woch.* 1929. Jan. 25. Vol. 45. No. 4. pp. 53–58.

The red corpuscles of the camel are bi-convex oval discs. They do not show much variation in size. The average length is 7·21 $\mu$, breadth 4·08 $\mu$ and thickness 1·38 $\mu$. The average number of red corpuscles exceeds 11,000,000 per cubic millimetre on an average. The average maximum osmotic stability was about 0·18 per cent., and the minimum about 0·35 per cent.

The red corpuscles are very tenacious of their shape. In salt solution up to 10 per cent. there was no alteration, and the author could not observe any swelling in hypotonic solutions.

Leucocytes.—Both large and small lymphocytes are found in the blood of the camel. The small lymphocytes are rather larger than red corpuscles. The large lymphocytes are three or four times as large as the erythrocytes. They have rather less solid-looking nuclei than the small lymphocytes, and they frequently contain a few granules.

The neutrophile leucocytes are like those of other mammals.

The eosinophiles rather resemble those of birds.

The average leucocyte formula is as follows: Basophile, 6·34; Eosinophile, 3·03; Neutrophile, 52·8; Lymphocytes, 42·19; Monocytes, 1·38; transition forms, 0·26 per cent.

Leucocyte counts ranged from 10,630 to 18,300 per cubic millimetre, with an average of 13,950.

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